

## EXAMPLE 1

### **Design Description**

In this design, the ambient lighting system uses two, twenty foot of semi-indirect luminaires that are suspended in 2 rows of 5 each. Each luminaire employs (2) high lumen T8 lamps, all powered from high ballast factor electronic ballasts. The whiteboard task light is a linear wallwasher about 12 feet long that uses (3) Super T8 lamps. This design is appropriate for elementary schools where adult night classes are not held.

### **Lighting Controls**

To reduce the power consumption of the lighting system, each row of luminaires has one row of lamps that is automatically switched off when there is adequate daylight in the room. There are two daylighting zones, one at the window side and one at the interior side. When the room is unoccupied, an occupancy sensor automatically switches off all lamps.

There are two locations for classroom lighting controls. The first is adjacent to the classroom door. Here two switches labeled “Row 1” and “Row 2” allow the teacher to energize the two rows of ambient lighting when entering the room. The second control location is on the teaching wall. Here the Teacher Control Center or TCC houses the whiteboard luminaire on/off switch, manual overrides for A/V mode and a one hour quiet time override switch.

### **Pros**

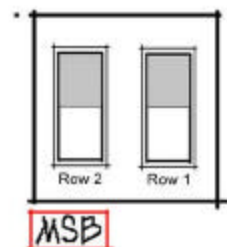
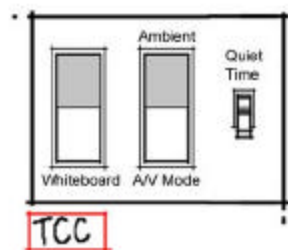
The luminaire used in this example is widely available from many manufacturers and has a variety of styles. It is also likely to be the least expensive and have the lowest life cycle cost of all examples.

### **Cons**

The A/V control in this example is most basic and will have less uniform desk-level illuminance than Examples 2 or 3. Also, the stepped switching control to daylight control may cause some classroom disruption and may not provide maximum energy savings.

# EXAMPLE 1 Reflected Ceiling Plan & Controls

## 2-LAMP T8 INDIRECT



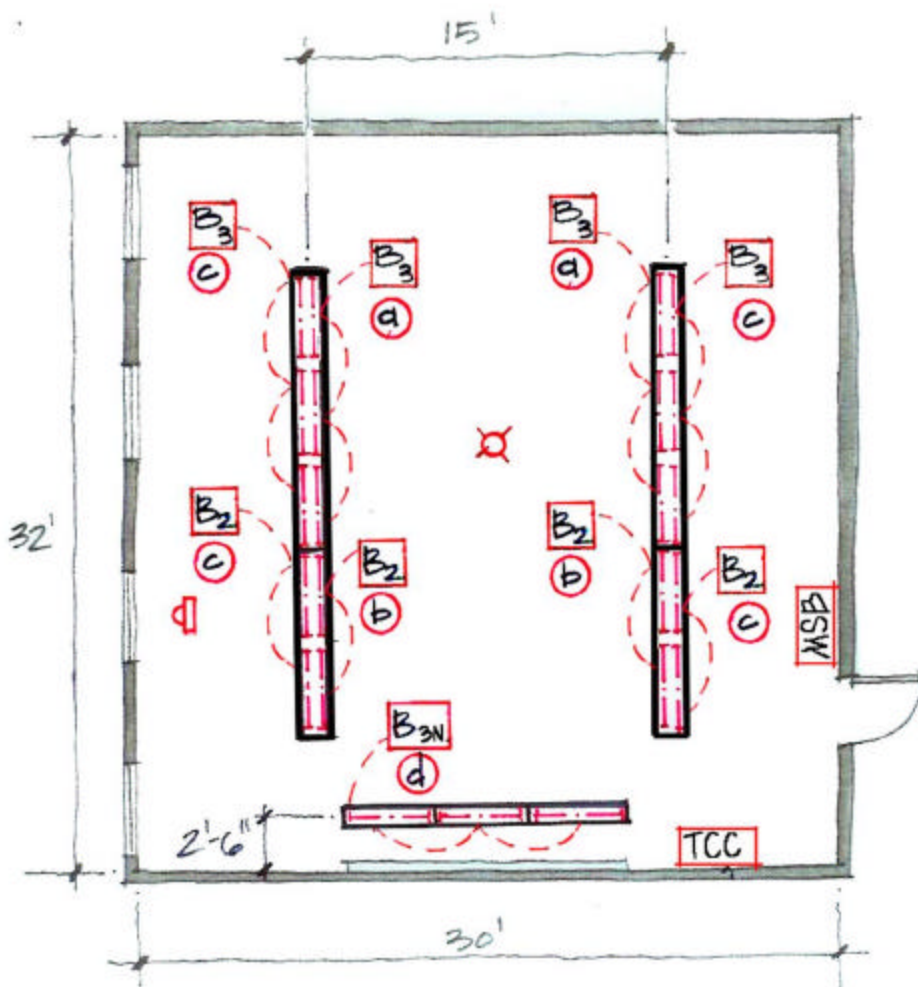
### CONTROL STRATEGIES

**Ambient** - Activates **a** **b** **c**

**A/V Mode** - Disconnects **b** **c**

**Quiet Time** - Momentary switch overrides occupancy sensor for one hour.

**Whiteboard** - Manually operates **d**



### LUMINAIRES

(20') 2-lamp Super T8 profile  
Perforated Bottom  
90% indirect / 10% direct  
- 3150 lumens per lamp  
- 35 watts per lamp  
- 1.2 Ballast Factor

(12') 1-lamp Super T8 profile  
Asymmetric Wallwash  
- 3150 lumens per lamp  
- 28 watts per lamp  
- 0.88 Ballast Factor

### BALLASTS

**B<sub>2</sub>** 2-lamp Ballast (high B.F.)  
B.F. - 1.2

**B<sub>3</sub>** 3-lamp Ballast (high B.F.)  
B.F. - 1.2

**B<sub>3N</sub>** 2-lamp Ballast (normal B.F.)  
B.F. - 0.88

### CONTROL DEVICES

- Occupancy Sensor (O.S.)  
locations & quantity per manufacturer
- Daylight Sensor (D.S.)  
locations & quantity per manufacturer

**MSB** Main Switch Bank (MSB)  
Located near door

**TCC** Teacher Control Center (TCC)  
Located near Whiteboard

### CONTROL CIRCUITS

- a** - MSB (manual-ON/OFF)  
- O.S. (auto-OFF)  
when unoccupied
- b** - MSB (manual-ON/OFF)  
- TCC A/V mode (OFF)  
- O.S. (auto-OFF)  
when unoccupied
- c** - MSB (manual-ON/OFF)  
- TCC A/V mode (OFF)  
- O.S. (auto-OFF)  
when unoccupied  
- D.S. (auto-OFF)  
with sufficient daylight
- d** - (manual-ON)  
- O.S. (auto-OFF)  
when unoccupied  
- A/V (manual-OFF)

## EXAMPLE 2: Dual Mode Fixture

### **Design Description**

The California Energy Commission has invested in the development of a prototype high performance classroom lighting system as part of its PIER (Public Interest Energy-Efficiency Research) program. This lighting system uses a (3) lamp Super T8 luminaire. The two outer lamps are used for a semi-indirect ambient lighting scene, and the third inner lamp is separately switched for use as a task light during projection and AV presentation. In this design, two, twenty foot PIER luminaires are suspended in 2 rows of 5 each. Each luminaire employs (3) high lumen T8 lamps. The 2 outer lamps are powered from high ballast factor electronic ballasts and the 1 inner lamp is powered from a dimmable electronic ballast. The whiteboard task light is a linear wall-washer about 12 feet long that uses (3) Super T8 lamps.

### **Lighting Controls**

To reduce the power consumption of the lighting system, each row of luminaires has one row of lamps that are automatically switched off when there is adequate daylight in the room. There are two daylighting zones, one at the window side and one at the interior side. When the room is unoccupied, an occupancy sensor automatically switches off all lamps. The inner lamp is dimmed for AV presentations. When the inner lamp is on, the outer 2 lamps are automatically switched off. The switches for the whiteboard are located near the whiteboard.

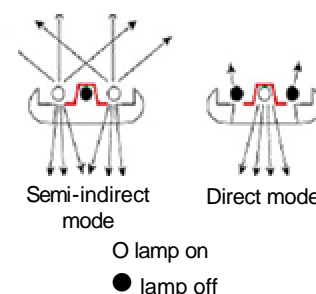
There are two locations for classroom lighting controls. The first is adjacent to the classroom door. Here two switches labeled “Row 1” and “Row 2” allow the teacher to energize the two rows of ambient lighting when entering the room. The second control location is on the teaching wall. Here the Teacher Control Center or TCC houses the whiteboard luminaire on/off switch, downlight/uplight switch, downlight manual dimmer for A/V mode and a one hour quiet time override switch.

### **Pros**

This example provides the most flexibility for different lighting scenes, especially for projection and AV presentations.

### **Cons**

The life cycle cost is higher for this design because of the extra lamps and ballasts.



## EXAMPLE 2 Reflected Ceiling Plan & Controls

### PIER LUMINAIRE

#### 2-LAMP T8 - SEMI-INDIRECT

#### 1-LAMP T8 - DIRECT

## LUMINAIRES

(20') 3-lamp Super T8 profile  
PIER Luminaire



### Semi Indirect Mode - outer 2 lamps

- 75% indirect / 25% direct
- 3150 lumens
- 35 watts per lamp
- 1.2 Ballast Factor

### Direct Mode - middle lamp

- 100% direct
- 3150 lumens
- 28 watts per lamp
- 0.88 Ballast Factor (dimming)



(12') 1-lamp Super T8 profile  
Asymmetric Wallwash

- 3150 lumens per lamp
- 28 watts per lamp
- 0.88 Ballast Factor

## BALLASTS

**B<sub>3N</sub>**

2-lamp Ballast (Normal B.F.)  
B.F. - 0.88

**B<sub>2</sub>**

2-lamp Ballast (high B.F.)  
B.F. - 1.2

**B<sub>2d</sub>**

2-lamp Ballast (dimming)  
B.F. - 0.88

**B<sub>3</sub>**

3-lamp Ballast (high B.F.)  
B.F. - 1.2

**B<sub>3d</sub>**

3-lamp Ballast (dimming)  
B.F. - 0.88

## CONTROL DEVICES



Occupancy Sensor (O.S.)  
locations & quantity per manufacturer



Daylight Sensor (D.S.)  
locations & quantity per manufacturer

**MSB**

Main Switch Bank (MSB)  
Located near door

**TCC**

Teacher Control Center (TCC)  
Located near Whiteboard.

## CONTROL CIRCUITS

**a**

- TCC Uplight (manual-ON)
- O.S. (auto-OFF) when vacant
- TCC Downlight (OFF)

**b**

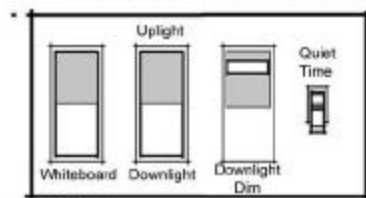
- TCC Uplight (manual-ON)
- O.S. (auto-OFF) when vacant
- D.S. (auto-OFF) with sufficient daylight
- TCC Downlight (OFF)

**c**

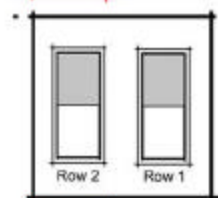
- TCC Downlight (ON)
- TCC Downlight Dim (manual-DIM)
- O.S. (auto-OFF) when vacant

**d**

- TCC Whiteboard (manual-ON)
- O.S. (auto-OFF) when vacant
- TCC Downlight (OFF)



**TCC**



**MSB**

## CONTROL STRATEGIES

**Uplight - Activates**

**a b**

Disconnects

**c**

**Downlight - Activates**

**c**

Disconnects

**a b**

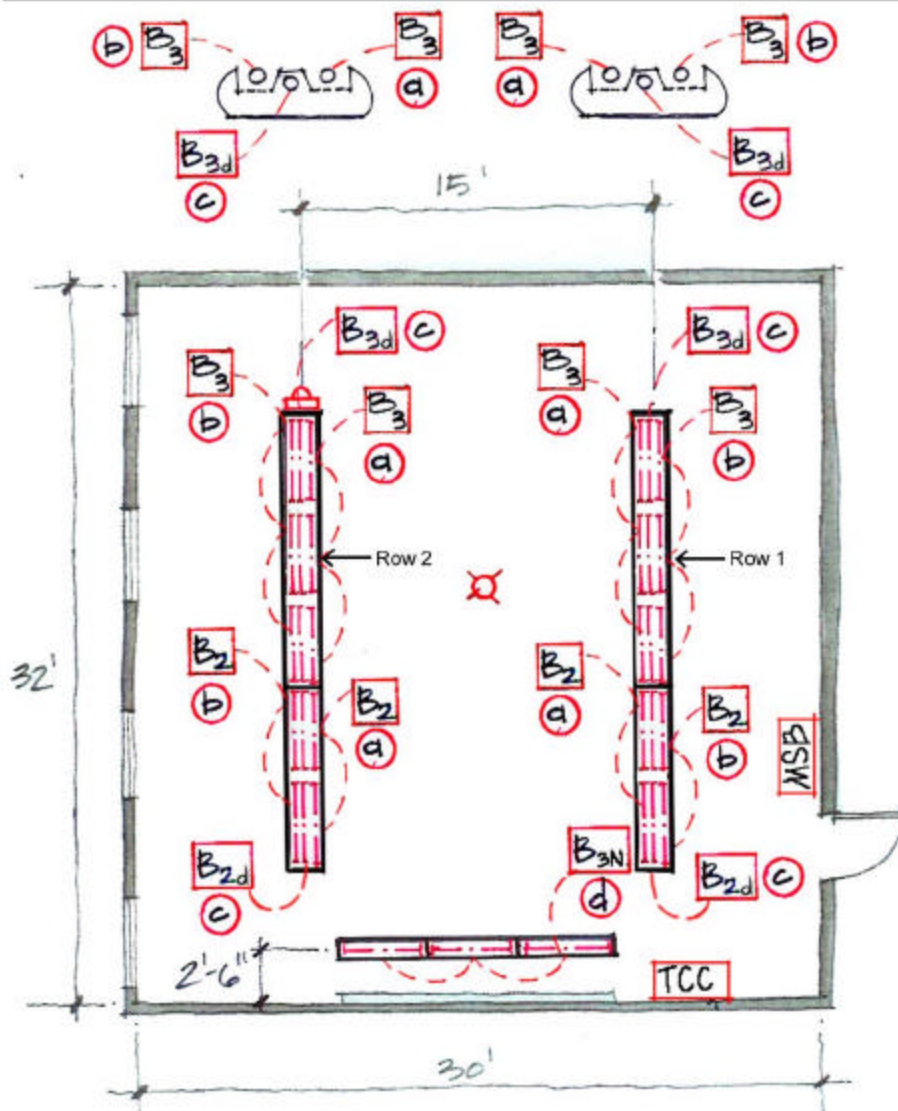
**Downlight Dim - Manually Dims**

**c**

**Quiet Time - Momentary switch overrides occupancy sensor for one hour.**

**Whiteboard - Manually operates**

**d**



## EXAMPLE 3

### **Design Description**

In this design, the ambient lighting system uses two rows of twenty foot direct-indirect luminaires are suspended in 2 rows of 5 each. Each luminaire employs (1) high lumen T5HO lamp, powered from high ballast factor electronic dimming ballast. The whiteboard task light is a linear wall-washer about 12 feet long that uses (3) Super T8 lamps. This design is appropriate for elementary schools where adult night classes are not held.

### **Lighting Controls**

To reduce the power consumption of the lighting system, each row of luminaires is continuously dimmed according to the daylight in the room. There are two daylighting zones, one at the window side and one at the interior side. When the room is unoccupied, an occupancy sensor automatically switches off all lamps. The switches for the whiteboard are located near the whiteboard.

There are two locations for classroom lighting controls. The first is adjacent to the classroom door. Here two switches labeled “Row 1” and “Row 2” allow the teacher to energize the two rows of ambient lighting when entering the room. The second control location is on the teaching wall. Here the Teacher Control Center or TCC houses the whiteboard luminaire on/off switch, manual dimming for A/V mode and a one hour quiet time override switch.

### **Pros**

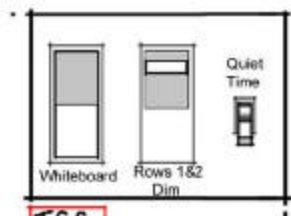
This example has the simplest controls that save energy and will be the easiest for teachers to use.

### **Cons**

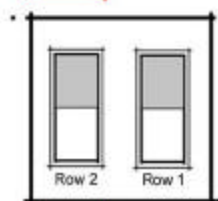
The life cycle cost is higher because of the lamp and dimming technology. Also, a single T5HO lamp provides end of illuminance levels of a classroom.

# EXAMPLE 3 Reflected Ceiling Plan & Controls

## 1-LAMP T5HO SEMI-INDIRECT



TCC



MSB

### CONTROL STRATEGIES

**Rows 1&2 Dim** - Manually dims Rows 1&2  
Manual dimmer sets upper limit for daylight dimming.

**Quiet Time** - Momentary switch overrides  
occupancy sensor for one hour.

**Whiteboard** - Manually operates **C**

### LUMINAIRES



(20') 1-lamp T5HO profile

- 82% indirect / 18% direct
- 4750 lumens per lamp
- 60 watts per lamp
- 1.0 Ballast Factor



(12') 1-lamp Super T8 profile  
Asymmetric Wallwash

- 3150 lumens per lamp
- 28 watts per lamp
- 0.88 Ballast Factor

### BALLASTS

**B<sub>2d</sub>**

2-lamp Ballast (dimming)  
B.F. - 1.0

**B<sub>3N</sub>**

3-lamp Ballast (normal B.F.)  
B.F. - 0.88

**B<sub>3d</sub>**

3-lamp Ballast (dimming)  
B.F. - 1.0

### CONTROL DEVICES



Occupancy Sensor (O.S.)  
locations & quantity per manufacturer



Daylight Sensor (D.S.)  
locations & quantity per manufacturer

**MSB**

Main Switch Bank (MSB)  
Located near door

**TCC**

Teacher Control Center (TCC)  
Located near Whiteboard

### CONTROL CIRCUITS

**a**

- MSB - Row 1 (manual-ON)
- O.S. (auto-OFF)  
when unoccupied
- D.S. (daylight dimming)
- TCC - Dim (manual dimming)

**b**

- MSB - Row 2 (manual-ON)
- O.S. (auto-OFF)  
when unoccupied
- D.S. (daylight dimming)
- TCC - Dim (manual dimming)

**c**

- TCC - Whiteboard  
(manual-ON/OFF)
- O.S. (auto-OFF)  
when unoccupied

